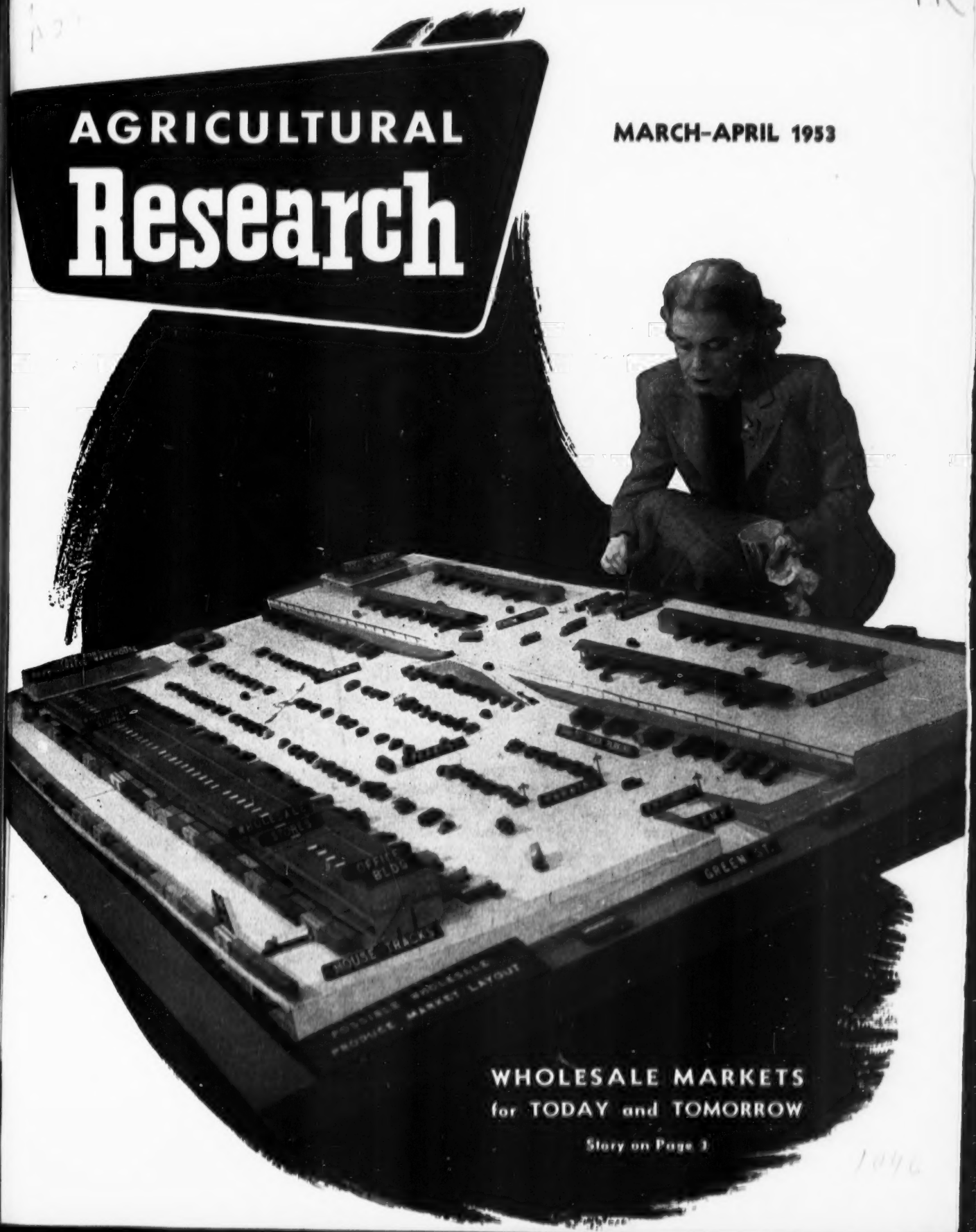
AGRICULTURAL Research

MARCH-APRIL 1953



WHOLESALE MARKETS for TODAY and TOMORROW

Story on Page 3

AGRICULTURAL Research

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About "Agricultural Research"

Most copies of this publication are distributed to State and Federal employees and USDA collaborators engaged in agricultural research, extension work, and teaching. We hope that you in this group will find the magazine an increasingly useful tool in your work.

The remaining copies—about one-fifth of the total—go to agricultural workers in industry, trade associations, the trade press, and farm press and radio. If you are in this group, you can get the magazine free only on request. After the May–June issue, we will ask you to state definitely whether you wish to stay on the mailing list.

Naturally our free distribution is limited. However, many to whom we cannot send free copies will want to receive Agricultural Research. Regular subscriptions, beginning with the July number, are $1 a year (12 issues). To get the first three bimonthly issues, send an extra 45 cents. Orders should be addressed to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Research and Extension

The regrouping of agencies in the United States Department of Agriculture by Secretary Ezra Taft Benson places the Agricultural Research Administration and Extension Service in the same group, along with the Bureau of Agricultural Economics, Office of Foreign Agricultural Relations, Forest Service, Soil Conservation Service, and the Agricultural Conservation Program. This group reports to Assistant Secretary J. Earl Coke, formerly Director of Extension in California.

No activities of the Department are more closely allied than research and extension. The Cooperative Extension Service was developed to take results of research to farm people. Extension workers have been salesmen of farm science for almost half a century.

The Land Grant College system never could have become the great force it is today in American agriculture had it not combined research and extension, along with classroom instruction.

AGRICULTURAL RESEARCH ADMINISTRATION
United States Department of Agriculture

SCALE MODEL of the proposed wholesale market for a city helps show local planners how the new facilities would make marketing easier, quicker, and more efficient (story on p. 3).

Contents

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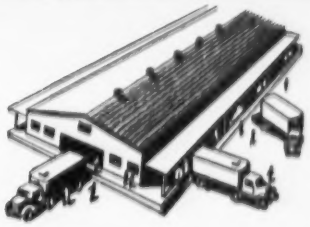
Wholesale Markets

for today and tomorrow



The new wholesale market opened recently in St. Louis is another step forward in the effort to reduce waste and inefficiency in bringing farm products to city consumers.

Like those opened in the past year and a half at San Antonio, Columbia, and Hartford—and those under construction at Indianapolis, Boston, and Savannah—it represents the combined efforts of industry, city and State officials, and USDA marketing research men.

Little work in planning improved markets was done by the Department until passage of the Agricultural Marketing Act of 1946, which provided authority for this activity. Principles developed by marketing specialists and applied to local conditions provide the basis for practical suggestions to local groups.

Marketing facilities geared to horse and buggy days have become obsolete and congested, and are inefficient in terms of arrangement for modern handling practices. They are wasteful of food and of labor.

The Department group develops plans for all kinds of marketing facilities, from the smallest to the largest. These include farmers' markets, livestock auctions, warehouses, grain elevators, city wholesale produce markets, and retail groceries.

A market such as that at St. Louis begins when a local group calls on marketing research men to study the need for new facilities and to suggest a location, design, and layout for use by the local group's engineers and architects.

The first job of the marketing specialists is to measure the waste in produce and labor caused by deficiencies in the existing facilities. They must then determine if improvements can be made at reasonable cost or if new facilities are needed.

If the decision is for a new market, they must determine the kind and amount of facilities needed and whether the investment will pay for itself by cutting costs of distribution. Then they must find the best location for the market, taking into consideration railroads, highways, land costs, location of buyers, and probable population trends.

Ordinarily, market research men recommend the purchase of more land than is immediately needed. Plans are developed for facilities that will meet both present and future needs, providing flexibility for changing conditions. They recommend that the market structure be so built that partitions can be erected to provide each wholesaler with the amount of space needed. For example, a small operator might require only one unit 22½ to 25 feet wide and a large operator might need eight units. Yet each could be accommodated.

Even the ceiling height is so calculated that if food handling requirements should change or even if a market should go out of the food handling business, the facilities still could be used efficiently for package goods or other types of operations.

The recommendations of the marketing specialists, furnished only upon request, are purely advisory. Their aim is not just to furnish assistance to the locality involved, but to cooperate in developing facilities that can serve as a pattern for other areas throughout the country.

A local group acting upon recommendations of the Federal marketing specialists must accept full responsibility for organizing, promoting, and arranging the financing of the enterprise. It must also make the final decision on location, design, and construction of the marketing facilities. This was done at the St. Louis market, as with most others.

Marketing research men have learned that more than half the total cost of marketing goes for labor and that a large part of the labor is in handling—picking materials up in one place and setting them down in another. The objective, therefore, is to design facilities and install equipment that will eliminate unnecessary handling operations and increase the productivity of labor.

In their efforts to find out precisely how to plan successful marketing facilities for all kinds of farm and food products under all kinds of conditions, they work closely with the State colleges, State bureaus of markets, and city officials, as well as industry groups.

A market ordinarily draws only a portion of the produce it handles from the nearby area (New York City, for example, obtains fruits and vegetables from 44 States). So good facilities are a matter of more than local concern. The efficiency or inefficiency of the market reflects back to the growers in every State from which the market draws it products and affects the quality and prices of products to consumers over a wide area.

Aware of the large investment private industry must make to establish the facilities, PMA marketing specialists gage their planning and recommendations so that the facilities will fill the demands of today and meet the needs of tomorrow.

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Now antibiotics control *Plant Disease*

I. Streptomycin prevents bean blight

Antibiotics look like the first big break in a long attempt to control bacterial diseases of plants, according to research men in the Bureau of Plant Industry, Soils, and Agricultural Engineering.

Greenhouse experiments by J. W. Mitchell, W. J. Zaumeyer, and W. P. Anderson first showed that halo blight of beans could be controlled by applying streptomycin sulfate to stems of the plants. Successful trials now have been made in the field at the Plant Industry Station.

If some way can be found to use a crude form of antibiotic rather than the expensive purified material, this weapon may be ready for farm use in the next year or two.

The greenhouse experiments indicated that streptomycin is absorbed by the stems and moves upward to nearby leaves in sufficient amounts to protect the plants from blight. No evidence was found that the antibiotic entered the pods in this manner.

Spraying the foliage with streptomycin sulfate completely protected greenhouse plants from the disease. Dihydrostreptomycin sulfate also was effective but seemed to check plant growth slightly.

In field trials at the Plant Industry Station, beans were sprayed with weak dilutions of streptomycin sulfate from one to four times at weekly intervals. Three days after the first treatment, the plants were inoculated by a high-pressure spray application of halo-blight bacteria.

More than 90 percent of the plants in untreated plots became infected. The treated plots were quite a different story. With one application of streptomycin sulfate, infection was reduced to 41 percent. Two treatments cut infection to 10 percent. And plots sprayed three times didn't show a single infected plant.

This was a severe test, Zaumeyer points out, because blight in the untreated plots was a constant threat to the sprayed plants during the trial. Two sprays might be enough in practical farm use.

ARA scientists plan further research on antibiotics and their use in the crude form for sprays and dusts.

II. Antibiotic-hungry bacteria aid in test

Bacteria-killing antibiotics are one of the great discoveries of modern science. So it may seem useless—perhaps even impossible—to develop bacteria that need deadly antibiotics to live.

Even some scientists may be surprised to learn, however, that such bacteria have been found. In fact, they already have been put to practical use in agricultural research.

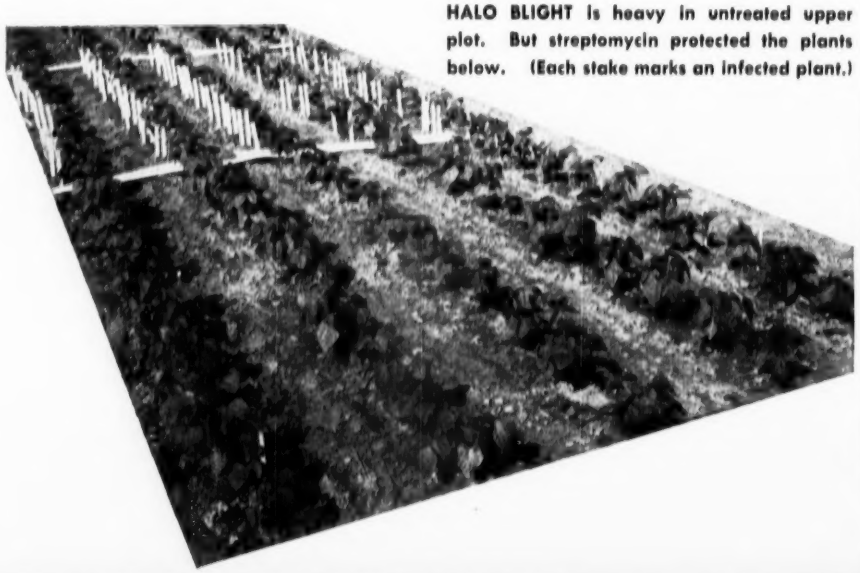
These rare antibiotic-consuming bacteria were isolated by W. P. Iverson of Rutgers University within the last few years. Out of about 9 billion of the bacteria, known as *Escherichia coli*, Iverson found 5 that were dependent on the antibiotic streptomycin for growth.

This incredible development now is helping ARA scientists solve the problem of halo blight of beans.

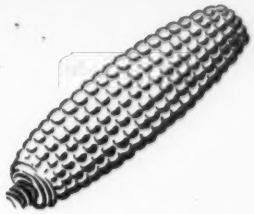
J. W. Mitchell, W. J. Zaumeyer, and W. P. Anderson had found that bean plants were resistant to halo blight after streptomycin was applied to their stems. But the scientists weren't sure why they got these results.

The streptomycin-dependent bacteria provided a way to find out. Some of these bacteria were put into the juice of bean leaves after streptomycin sulfate had been painted on the stems of the plants. The bacteria thrived, showing that they were getting from the leaf juice the food they couldn't get along without.

This helped prove that the antibiotic itself was absorbed by the bean stems and translocated upward into the leaves, apparently through the water-conducting cells.



HALO BLIGHT is heavy in untreated upper plot. But streptomycin protected the plants below. (Each stake marks an infected plant.)



More CORN to the acre

More corn to the acre means a saving of labor, more land available for soil improving crops, and more profit to farmers. A recent study by State and USDA farm economists showed that it would pay farmers to use practices that could boost corn yields about 7 percent above the average 1952 yield of 40.6 bushels to the acre.

These practices, developed by research, now make good yields possible in any area where land is adapted to corn. Yet, more than 25 percent of the land planted to corn is producing less than 20 bushels per acre. Some of this acreage should not be used for corn, but most of the land can be improved.

Tested practices for increasing corn yields can be summarized under six headings:

1. Hybrid Corn. In many areas hybrid seed is still seldom used. For some areas suitable varieties must be developed. Even in the Corn Belt, the use of hybrids better suited to the particular farm would improve yields. For good results, farmers should use certified seed that has been treated against disease and is uniform in both size and shape.

2. Soil Management. Much corn is produced on land that must be adapted to this crop. Good soil management includes:

a. Rotations that add organic matter and nitrogen to the soil and improve soil structure. It is estimated that Corn Belt farmers should use a rotation that includes about 5 percent less acreage in corn to obtain optimum production of feed crops. This reduction in acreage can be made up in part, if not entirely, by use of more fertilizer.

b. Soil conserving practices such as terracing, contour strip-cropping, and improved drainage as needed. In dry areas, subsurface tillage combined with proper soil protecting rotations is necessary.

c. Soil sampling and testing to find out what the soil needs to increase productivity. Lime and fertilizer needs can then be determined accurately. Soil samples are analyzed at State experiment stations, or offices of county agricultural agents.

d. Fertilizers. Balanced fertility is vital. The biggest boost to yields on most farms can come from proper use of barnyard manure, green manure, crop residues, and chemical fertilizers, making especially sure there's enough nitrogen. Yellow leaves are a sign of nitrogen deficiency. Young leaves purple-colored indicate lack of phosphorus. Shriveled leaf edges denote potash shortage.

e. Side dressing with nitrogen. Even with good fertilizing practices, many fields don't have enough nitrogen for big crops. If more nitrogen is needed, many good farmers add it when the corn is knee high. Liquid nitrogen in many cases is cheapest and is easy to apply.

A rule of thumb for fertilizers might be this: for every 2 to 2½ pounds of nitrogen added to each acre, the yield should increase by 1 bushel of corn.

3. Proper Planting Practices. For best yields, corn must be planted at the right time. If planted a week late, for example, the yield may be cut 5 bushels or more. The number of stalks per acre also is important. To get more corn you need more plants—but plant nutrients and water supply must be adequate. To get more plants, use adapted hybrids that tolerate thick planting and space them as close as the soil and expected water supply will justify.

A rule of thumb: to get a 20-bushel increase to the acre, add the equivalent of 1 seed to every hill in 40-inch rows.

If you have the right number of plants to make the best use of soil, moisture, and fertilizer, the ripe ears of corn will weigh about one-half pound each. If the ears are larger, you didn't have enough plants. About 14,000 plants to the acre are usually necessary to get 90 to 100 bushels. Dry weather, of course, may bring lower yields.

4. Weed Control. High yields and heavy weed growth don't go together. Good seedbeds keep down weed growth. When weeds appear, early cultivation is best—and it should in most cases be shallow. Repeat once or twice if needed until corn is knee-high. Then stop. Extra cultivation of large plants doesn't pay, and it may hurt by cutting off surface roots. This reduces yields. Chemicals also can help, especially if a wet spring has hampered cultivation. New chemicals and new-type nozzles make it easy to kill weeds with minimum harm to the corn.

5. Insect Control. Insects take about 15 percent of the corn crop every year. Use hybrids that resist the insects prevalent in your area. Spray carefully. The new insecticides do a thorough job with little material. Where European corn borer is a problem, sometimes plowing under last year's stalks before the moth

appears helps give effective control.

6. Drying and Storage. Machine harvest often raises problems of moisture in the corn. Moisture content should be measured if corn is to be stored on the farm. Fans can be used to dry the corn, when electricity is available. Driers using heated air are excellent in all kinds of weather. In any case, the crib or bin should be located to allow plenty of air to circulate, and be properly designed and built to protect the corn against rats and mice.

Good storage means control of storage insects like the rice weevil. One-third of the harvested corn in the South is ruined every year by insects and poor storage methods. Put corn only in bins or cribs that are clean of last year's trash, and have been sprayed if insects were present in the previous crop. Clean storage will save more corn for sale or use on the farm.

That's the list. Local recommendations can be supplied by the county agent, soil conservation district representative, local farmer committee, or State experiment station.

New chemical weed killers

The man with the hoe appears on the way out of the cotton field, thanks to chemical weed killers.

Experiments conducted by W. C. Shaw and C. R. Swanson at Beltsville indicate that several carbamate and urea derivatives may effectively control weeds in cotton and other crops when applied as preemergence sprays. Several of the most effective ones controlled weeds for 30 to 90 days with little or no injury to the cotton.

The new carbamates are closely related to isopropyl N-phenylcarbamate (IPC) and isopropyl N-(3-chlorophenyl) carbamate (CIPC). Among those showing the most promise as herbicides are isopropyl N-(3-methylphenyl) carbamate, isopropyl N-(3-chloro-6-methylphenyl) carbamate, isopropyl N-(3-chloro-6-methoxyphenyl) carbamate, and *sec* butyl N-(3-chlorophenyl) carbamate. They do not have common names as yet.

The new chemicals were most effective when applied as preemergence sprays or to weeds in the seedling stage of growth.

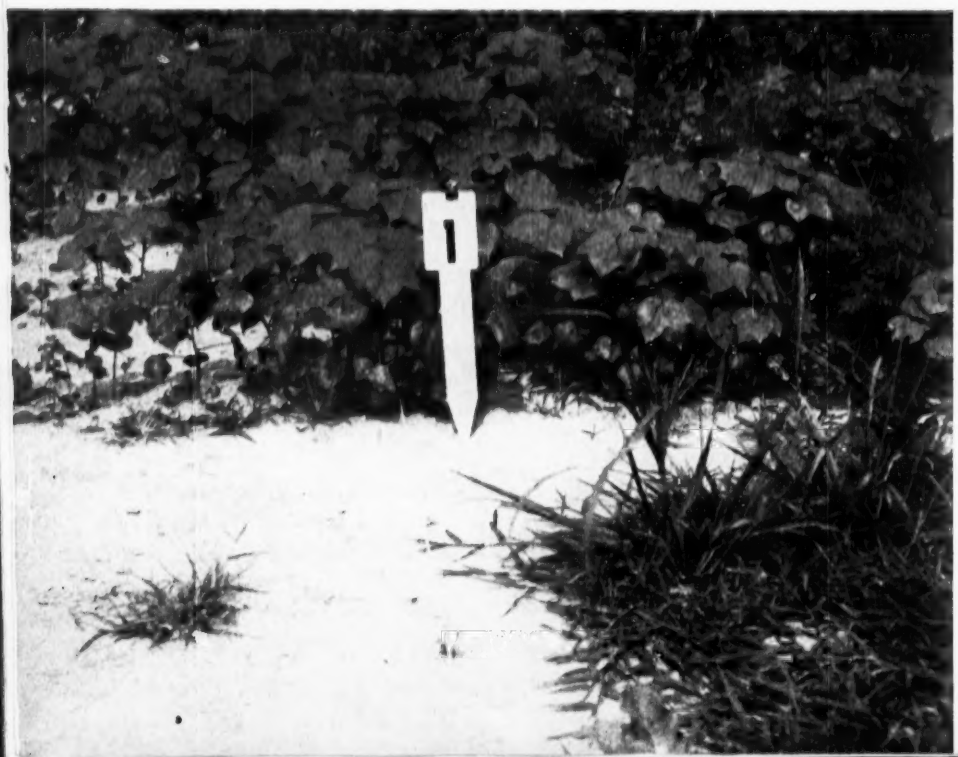
These carbamates were quite selective in action, and some were effective on weed species not susceptible to IPC and CIPC. In general, they were most effective against annual weedy grasses. However, several derivatives also worked very well on broad-leaved weeds. Two of the new compounds inhibited chlorophyll production in crabgrass, wild oats, ryegrass, pigweed, and mustard to such an extent that these weeds soon turned white and died.

In other experiments dealing with urea derivatives, phenyldimethylurea, a chemical closely related to CMU, showed promise as a preemergence herbicide and semipermanent soil sterilant. Preliminary tests showed it has about the same activity as CMU but is more soluble and appeared to kill weeds more quickly.

The Division of Weed Investigations of the Bureau of Plant Industry, Soils, and Agricultural Engineering, working in cooperation with the chemical industry, has completed greenhouse experiments with more than two hundred new compounds. These chemicals have been evaluated for the control of crabgrass, ryegrass, pigweed, and mustard, in cotton, soybeans, wheat and corn. The most promising have been further studied in preliminary field tests for weed control in 30 of our most important field and horticultural crops.

The chemical industry is producing experimental quantities of the most promising compounds for further field evaluation. None is available yet for commercial use.

CARBAMATES kept down weeds in Beltsville tests. A preemergence application of isopropyl N-(3-methylphenyl) carbamate at 8 pounds per acre (left) gave control of grasses and broad leaved weeds in cotton for 70 days with little or no injury to cotton. Right, untreated plot.



Science Is Battling the *Pink Bollworm*

PINK BOLLWORM inside caused this rosetted cotton bloom. Petals are stuck together, don't open properly.

A fight is shaping up in the South. Scientists are massing their wits to counterattack the world's worst cotton pest, the pink bollworm, which has burst out of its beachhead on the Texas Gulf Coast.

Eating out the seeds and ruining the lint, this insect destroyed an estimated 28 million dollars worth of cotton in southern Texas last season. The pink bollworm was found in 48 new counties in Texas, Oklahoma, and Louisiana in 1952, and earlier had spread into New Mexico and Arizona. These five States produce more than a third of our crop.

Survey, quarantine, research, and cooperation of growers and processors had kept the pink bollworm in check since it came to this country in 1917. In 1951, however, bad weather kept many growers out of their cotton fields after harvest—when stalks must be cut and plowed under to prevent a heavy build up of the pest. Now, trouble is spreading.

But let's take a look at the defense line, where ARA and other agencies are carrying on nearly 30 phases of pink bollworm research:

In recent cooperative work at the Texas Agricultural Experiment Station, scientists have learned to grow pink bollworms all the way from egg to moth with a modified chick diet high in fatty acids.

What they're trying to do, of course, is to pin down the essential food requirements of the pink bollworm. Once that is known, scientists may be able to breed cotton that won't satisfy these needs. Or it might be possible to use an insecticide that will upset the digestion of the worm so it won't be able to use the essential foods.

A lot of effort is being given to finding a systemic insecticide—one that growing cotton will absorb in quantities large enough to kill pink bollworms that eat the plant. Scientists have found a dozen systemics that will kill this pest under laboratory conditions, but there's much to be learned before farmers can use them in the field. For example, we couldn't risk a chemical that left harmful residues in the seed, fiber, or soil.

A good systemic insecticide would save extra spraying or dusting because poison already in the plant would spread into new fruit and leaves. Rain can't blow away a systemic and rain can't wash it off. Most important of all, such a chemical would kill the pink bollworm inside the plant where ordinary insecticides can't reach.

New results in light-trap research by USDA engineers and entomologists give promise of more effective surveys—and maybe even control—in the infested areas. Entomologists once thought the pink bollworm wouldn't fall for a light trap. But last season they caught thousands of moths with an almost-invisible ray toward the lower end of the color spectrum.

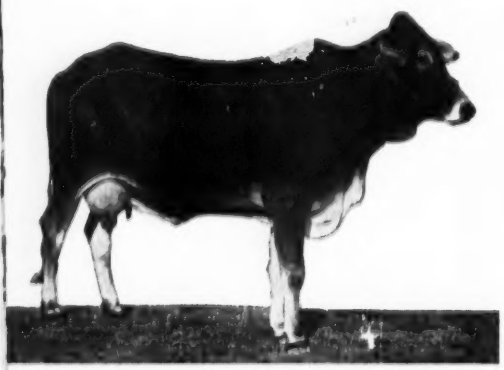
Parasites also may be used against the pink bollworm. An entomological explorer is now in India looking for natural enemies of this pest. Several already have been found and the first shipment of one of the more promising reached the Bureau's parasite laboratory at Moorestown, N. J., early in January.

Those are only a few of the points of attack. Entomologists are going into every phase of the physical makeup of the pink bollworm and the way it lives, how it hibernates and travels, and diseases that might be used against it. Chemical defoliators, herbicides, and fumigants are being studied. Stalk shredders and other equipment, cultural practices, and cotton breeding all seem to offer good approaches. So things look bad for the pink bollworm.

Breeding for a HOT-WEATHER

RED SINDHI bulls from one of India's outstanding herds are mated with Jersey cows in one phase of search for a good southern cow. The humped cattle adjust well to hot weather.

SINDHI-JERSEY cross has better heat tolerance, on average, than Jerseys. Milk production of crosses has been good. Their growth rate is slightly faster than that of Jerseys.



VARIOUS combinations of Sindhi and Jersey are used for heat tolerance study. In three-fourths Sindhi cows (above), the average heat tolerance improves, milk production drops off.

A cow that doesn't mind hot weather is one goal of ARA scientists in the Bureau of Dairy Industry.

Their efforts have already produced new facts about cows, as well as some of the most unusual animals and laboratories in dairy history.

Six State agricultural experiment stations are cooperating with the Bureau, which is doing much of the work at the Agricultural Research Center at Beltsville, Md.

That's the home of the widely publicized Red Sindhi-Jersey crosses. They represent 1 of 3 breeding approaches to the problem of developing a cow adapted to the South.

We knew little about the milking qualities of India's humped cattle, explains the Bureau's R. E. McDowell, but they did seem to have greater heat tolerance than the European breeds we raise here. Dairy scientists thought it might be possible to combine the heat tolerance of the humped cattle with the producing ability of our own breeds. So, late in 1946, 2 young males and 2 young females of the Red Sindhi breed were brought to Beltsville from India's Allahabad Agricultural Institute.

The Sindhi bulls were mated to Jersey cows. Today, there are 200 females with 6 combinations of Jersey and Sindhi blood. Similar research is being carried on at the Louisiana and Georgia stations.

A second breeding approach—the opposite of the first—is under way at the Texas station. Here, Jersey bulls are being crossed with local Brahman females, which are descendants of some humped breeds of cattle imported from India many years ago.

There's also an attempt to develop heat-tolerant animals by selection within the various European breeds. This third breeding approach is being studied at the South Carolina, Tennessee, and North Carolina stations.

The scientists faced many problems as they started work at Beltsville. First, they needed standards to compare one animal with another and one breed with another in regard to their ability to withstand hot weather. A good measure of the lack of heat tolerance seemed to be changes in body temperature. Cows, like humans, run a temperature when they're under stress, as from extreme heat.

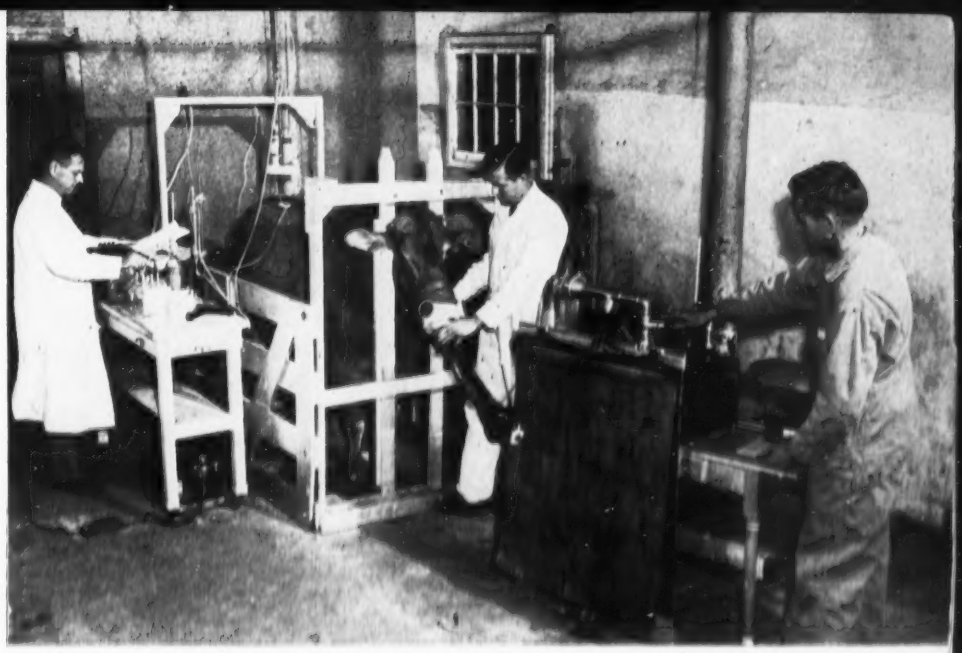
To get accurate results, of course, every cow had to be exposed to exactly the same unfavorable conditions. So a large climatic chamber was built.

McDowell found that the Sindhi-Jersey animals, on the average, showed better heat tolerance than the Jerseys. This seemed to indicate that the crosses had benefitted from the Sindhi blood. Even so, the heat tolerance of some Jerseys was good and that of some crosses was poor, so crossing didn't necessarily produce a heat-tolerant animal.

That brings up the toughest question of all: What physiological factors account for the difference in heat tolerance? Only when the scientists are able to answer that question will they know what factors to look for in their breeding program.

The most obvious possibility seemed to be that Sindhis were better equipped than Jerseys to get rid of excess body heat. With the help of

...ER COW



CLIMATIC CHAMBER is used to test heat tolerance of cattle. Temperature can be raised rapidly to 105° with 60-percent humidity. This is enough to burden the most heat-tolerant animals, yet not injure weaker ones. Metering device (right) measures respiratory volume as cow breathes into comfortable mask. Skin evaporation, skin temperature also are being checked.

specialists from Johns Hopkins University, tests were set up to compare cows on the basis of five ways in which heat is given off:

1. *Surface Area.*—One popular theory was that the hump, large ears, and full dewlap of the Sindhi gave it more body area and therefore a larger surface to radiate heat. The crosses have these Sindhi features. But actual measurements of Jerseys and crosses of equal weight showed no significant difference in surface area.

2. *Skin Temperature.*—Small wire thermocouples were used to check skin temperature at some 250 points on the side of each cow. In tests made at both 60° and 100°, Jerseys and crosses seemed to run much the same skin temperatures under similar conditions.

3. *Respiratory Volume.*—The first response to heat—and one of the most effective means of cooling—is to step up the breathing rate. The crosses appeared to have some advantage over the Jerseys, but the margin was not enough to account for the difference in heat tolerance.

SWEAT, as well as the moisture that passes through the skin, can be measured with this device. European and humped cattle both have sweat glands at base of each hair follicle.

4. *Sweating.*—The scientists are still working on this one. Moisture is given off by the sweat glands and also passes through the skin. Which of these processes accounts for more of the moisture loss in animals is not yet known.

Recently, however, McDowell has found a way to knock out the sweat glands temporarily in a small area. This enables him to measure just the moisture that passes through the skin. Subtracting that from the total moisture output in a similar skin area will show how much is given off through the sweat glands.

One point that may be significant: humped breeds have more numerous hairs than European breeds and therefore more sweat glands.

5. *Hair Coat.*—This is another unanswered question. A thick coat acts as an insulator. The Sindhi coat consists of an extremely large number of short, fine hairs. European breeds, on the other hand, have long, coarse hairs but fewer of them. The coats of the crosses are more like those of the Sindhi. This type coat helps resist ticks, but the scientists don't know whether it offers any advantage in heat tolerance.

It is possible that the explanation of heat tolerance will not be found in any of these heat-loss factors. Then, the next logical step might be to look into the matter of heat production. Perhaps the European breeds generate more heat in the operation of body processes.

Another point to keep in mind is that the crossbreeding programs aren't necessarily the answer to a better southern cow. Selection from among European breeds offers promise because they already have producing ability and there's a large population from which to choose.

But the big job right now is to find out what makes a cow stand up well under heat. Then scientists will be able to breed for characteristics that impart heat tolerance.

Finding out about Frozen Foods

The fast-growing frozen-food industries are calling for information to help them get their products to consumers in top condition.

This information is vital to them, because reduction in quality means loss of food, loss of consumer confidence, and reduced sales. The industry knows that proper temperature during marketing is the key to maintaining the quality. But the cost of refrigeration goes up fast as temperatures are lowered. To reduce temperatures very much during transportation would require new and costly equipment.

At the request of the industries, the Bureau of Agricultural and Industrial Chemistry has set out to determine the effect of fluctuating temperatures on the quality of frozen foods. The tests are being made at the Western Regional Laboratory at Albany, Calif.

Storage rooms have been constructed in which frozen foods are subjected to all the temperatures they would encounter under commercial conditions. For example, frozen strawberries are placed in the room at warehouse temperature. The temperature is then changed periodically to simulate moving out of the warehouse, loading on refrigerator cars, transporting to wholesale distributors, trucking to retail stores, and final storage in refrigerated display cabinets. By testing at strategic times, the scientists can tell at what temperature and at what point in the marketing channel the product begins to deteriorate.

Although findings so far are only a beginning, they are important steps toward the answers needed. Here is a summary of progress to date:

All the products tested have had one characteristic in common: a certain limited "tolerance" to temperature fluctuations. But early mishandling, even insufficient to change the product noticeably, uses up most of the product's tolerance so that it is then quite sensitive to any later adversity. This tolerance apparently can be used up by a long period of storage at a good freezing temperature as well as by a short period under conditions of partial thawing, the scientists find.

Browning of individual cherries was the first change the scientists noticed in frozen red-sour cherries, as a result of adverse storage conditions. As the browning progresses, off-flavor becomes increasingly apparent. In sliced peaches packed in ascorbic acid-sugar sirup, browning of exposed slices is the first symptom of trouble; off-flavors and softening of texture follow. Leaving a headspace in the packed container speeds the browning.

The first changes in raspberries packed in sirup are bleeding of the color into the sirup and a transfer of sugar from the sirup to the berries, followed by decided softening of the fruit. In strawberries, loss of vitamin C and change in color are the most sensitive indicators of storage deterioration.

In orange juice concentrate, the first noticeable change is separation of the liquid and settling ("loss of cloud").

Tests have been started on frozen peas and snapbeans, and other vegetables and poultry products are to be added soon.

Orange Powder makes tasty, nutritious juice

An orange powder that dissolves instantly in ice water to make a juice with the color, flavor, and nutritive value of fresh orange juice is the result of recent research in the Bureau of Agricultural and Industrial Chemistry. Furthermore, the powder can be stored on the kitchen shelf with other staples.

The new process, developed by chemists at the Western Regional Laboratory, begins with juice concentrated at a low temperature and containing at least 50 percent soluble solids. The concentrated juice is poured onto metal trays to make a liquid film about one-eighth inch thick. The trays are then inserted into a vacuum chamber equipped with tubes or hollow shelves, which support the trays. Steam or water is circulated in the shelves or tubes so the juice can be rapidly heated or cooled.

The pressure and temperature during the drying period are controlled in such a way that the concentrate, as it dries, puffs up to as much as 20 times its original volume. The resulting open spongelike structure

JUICE puffs as it dries in vacuum chamber. Steam, water run through hollow shelves.

makes the dried juice easy to break down into a fine, flaky powder. This flakiness is what causes the powder to dissolve so readily in water.

The scientists then had to restore the fresh orange flavor lost during drying. They did this by adding natural orange oil, stabilized by a commercial technique using sorbitol, a relatively inexpensive edible material, which locks in the flavor until the powder is dissolved.

They solved the storage problem by packing the powder in hermetically sealed cans along with a small package containing a drying agent, which absorbs most of the moisture left in the powder. This packaging procedure, also developed at the Laboratory, makes it possible to remove the powder from the drier with a moisture content of 3 percent or higher instead of the 1-percent moisture that generally is assumed necessary for safe storage.

Because the new process has succeeded so well in laboratory and pilot-plant studies, the Army Quartermaster Corps is testing the new product for possible military use. The powder is not yet available commercially. In the meantime, the scientists are continuing their studies with juices of other fruits and vegetables and already have promising results in making beverage powders from other citrus fruits, tomatoes, pineapple, apples, and grapes.

"Synthetic" Alfalfa

A "synthetic" strain of alfalfa—obtained by a combination of several strains—is under cooperative test with Nevada Agricultural Experiment Station. Known as Nevada Syn–A, this strain has shown resistance to stem nematode and bacterial wilt, which damage alfalfa in irrigated areas. It's not adapted to midwestern and eastern States because of susceptibility to leaf diseases.

New varieties must be GOOD

Few people realize how much trouble fruit and vegetable breeders take to make sure of good eating quality and food value in the new varieties released year after year. Taste, appearance, and nutritive quality are among the first of many tests that a prospective new variety must pass before it is released for commercial production.

The breeder's simple description such as "superior quality" or "satisfactory quality" cloaks painstaking efforts to find out how the new vegetable will meet the needs—even the prejudices—of consumers.

Sunnyside, a new sweetpotato released several weeks ago, is a case in point. It's typical of what happens.

Sunnyside is a new "moist" type sweetpotato much desired by canners and growers on the Eastern Shore of Maryland to replace the dry Maryland Golden variety, which has good quality but stores poorly and is subject to cracking. Sunnyside was released jointly by the Bureau of Plant Industry, Soils, and Agricultural Engineering and Maryland Agricultural Experiment Station. By next fall a few Sunnyside sweetpotatoes will be on dinner tables, although most of the crop will be kept for seed.

In recommending it for commercial trial in the Middle Atlantic area, the breeders stated: "The bland flavor, tan skin color, and lack of resistance to wilt leave something to be desired in this variety. . . . It is probable that in a few years Sunnyside will be superseded by other superior varieties."

Even though breeders consider Sunnyside only a temporary replacement for Maryland Golden, they believe it will be pleasing to consumers. To gain approval, a new sweetpotato variety has to meet two eating quality standards: first, that its over-all eye appeal and edible qualities are at least equal to those of the best commercial varieties now available and, second, that there be high nutritive values, including adequate content of vitamins.

How was Sunnyside tested? Sample roots of the first experimental crop grown at Beltsville in 1946 were baked, and a panel of trained tasters tried them out. Was the taste pleasing? How was the color, and was it uniform? What about sweetness? And texture? Were there too many fibers? The panel members recorded their reactions on each of these questions, and many more.

But that wasn't all. In 1947, cooking and taste tests were repeated, and in the following years, repeated again, even as yield, resistance to various diseases, and other qualities were being checked and rechecked.

The chemists also went to work. They found the quantity of carotene, the provitamin A, in Sunnyside is about one-fifth more than in good strains of the Porto Rico sweetpotato, the standard. The canners went to work. What about consistency? It must be neither too soft and mushy,

nor too firm and "dry." How did the color hold up in the can, and after opening the can? Sunnyside came out all right on these tests, too.

Although the bland flavor of Sunnyside does not make it an outstanding sweetpotato for baking, in its canning qualities it surpasses Maryland Golden, which it will probably replace. Extensive tests showed that its flesh color, shape, keeping quality, and ability to stand up under handling when canned make it highly desired by the food processors.

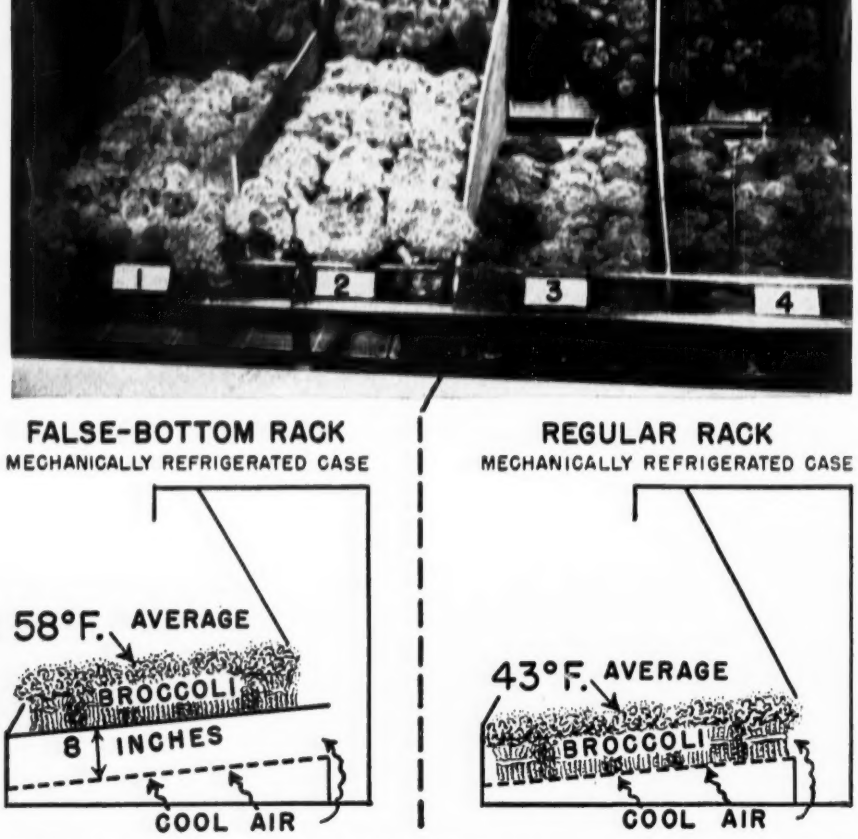
The Sunnyside story is typical in fruit and vegetable breeding. Apples, peaches, strawberries, potatoes, beans, and many others are rated for appearance, color, texture, flavor, and even vitamin content. The same tests are applied to varieties intended for canning or freezing.

This constant over-all attention to the consumer's interests and desires in breeding new varieties of vegetables and fruits is making our foods more nutritious, better in appearance, and adapted to modern methods of storage, handling, and home cooking or factory processing.

Fresh fruits and vegetables

Retailers want to keep their produce fresh and attractive. And housewives want these fruits and vegetables to stay that way till ready for use.

Answers on how to please both the retailer and the housewife are coming from ARA research in handling, transportation, and storage.



BROCCOLI raised above cold-air source by false-bottom racks (1, 2) shows yellowing and wilting. Sections 1, 3 were not sprinkled; sections 2, 4 were sprinkled four times daily. Without refrigeration, broccoli often has only 1 day's shelf life in the retail store. With refrigeration, 2 or 3 days of shelf life is assured if the broccoli is kept moist by sprinkling or garnishing with ice.

Fruits and vegetables don't die when they are harvested, reminds horticulturist W. E. Lewis. Breathing and other physiological changes go right on. Cooling, however, will cut the breathing rate, slow aging, and hold back decay.

Laboratories at the Plant Industry Station are equipped with display cases and storage refrigerators. Using these facilities for shelf-life studies, the scientists can match conditions found in retail stores.

A test on tangerines is one of the latest. Lewis found that the ordinary life of unrefrigerated tangerines in retail stores is about 3 days. But refrigeration will keep the fruit attractive and tasty for more than a week.

Some lots of tangerines displayed on nonrefrigerated racks were stored in walk-in coolers at night. Decay was much lower in these lots than in those receiving no refrigeration at all. Tangerines that were well refrigerated both day and night, and were kept moist by sprinkling with water several times daily or by garnishing with ice, had a good appearance throughout the test period. Refrigeration held down decay, and wetting reduced drying of the skin.

Other work has included tests with broccoli (see pictures), snap beans,

beets, carrots, cauliflower, cucumbers, lettuce, onions, and radishes. They were subjected to these practices:

1. Display in a nonrefrigerated case during the daytime; storage in an iced produce barrel and in walk-in coolers at 32°, 40°, and 50° F. at night.

2. Display on both false-bottom rack and regular rack in a mechanically refrigerated case.

3. Display in an ice-bed case.

Details of these studies are reported in Handling, Transportation, and Storage Office Reports 247 and 278. Copies of the reports may be obtained from W. T. Pentzer, Plant Industry Station, U. S. Department of Agriculture, Beltsville, Md.

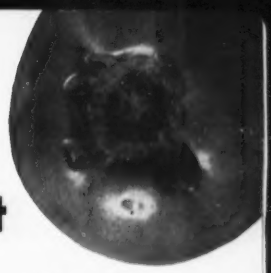
Pick them ripe?

Most peaches sold in stores are picked while still firm and ripen on the way to market. Recent tests suggest that commercial growers may find it profitable to pack ripe peaches for nearby markets despite the extra cost of handling.

In a recent marketing study, peaches of three degrees of ripeness—ripe, firm-ripe, and firm—were placed side by side in stores in Denver and Milwaukee. No signs or labels except price tags were used. About half the peaches sold were the ripe ones, although they cost the housewife 1 to 7 cents a pound more than the firm-ripe peaches, which sold at normal retail price. The firm-ripe peaches accounted for one-third of the sales. The firm peaches, priced below the normal retail price, accounted for only one-sixth.

It costs growers and shippers more to handle tree-ripe peaches; they bruise easily and losses are high. Studies are needed to learn whether the premium that housewives are willing to pay for the better-eating fruit will cover the extra costs.

Chilling brings on Alterneria Rot



Chilling injury, opening the way to alterneria rot, often accounts for heavy losses on tomato shipments. That warning comes from ARA scientists who have just completed laboratory and transit studies.

This research indicates tomatoes are headed for trouble when they're held at low temperatures for long periods. The fruits won't ripen, and decay soon follows. Chilling may occur in the field, in transit, or after tomatoes reach market.

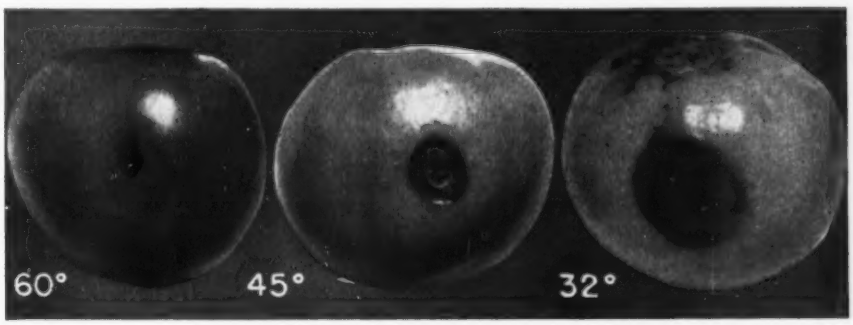
The fungus that causes alterneria rot becomes established on the tomato stem scar while fruits are still in the field, says pathologist L. P. McColloch. But no rot develops unless the tomato tissues are weakened by long exposure to cold.

McColloch and J. T. Worthington made laboratory chilling tests in which they inoculated tomatoes by placing fungus in a small wound on the side of each fruit. Infected tomatoes held at 32° to 40° F. for 3 to 5 days still ripened satisfactorily without increased decay. But 6 days at 32° or 9 days at 40° began to cause trouble. Each additional day at low temperature brought increased decay. Lowest temperature the tomatoes would stand for long period was 55°.

Transit studies of rail and truck shipments showed that tomatoes often undergo a combination of cool weather in the field and low shipping temperatures. Iced cars shipped cross-country may be diverted from one market to another or held on track several days under ice before unloading. Such tomatoes look fine when they come from the car. But seriously chilled fruits begin to rot after 2 or 3 days in the ripening room at 60° to 70°.

What's needed, of course, is just enough refrigeration to cool the tomatoes rapidly to 60° to 65°, then hold them between 55° and 65° till they get to market. Ice and ventilation requirements to do this job under a variety of conditions in the major producing areas are being worked out by the Division of Handling, Transportation, and Storage of Horticultural Crops. California Agricultural Experiment Station is cooperating on work in that state.

Progress reports on this research will be issued soon by the Bureau of Plant Industry, Soils, and Agricultural Engineering.



ALTERNERIA ROT got worse as holding temperatures dropped. Fungus was put in wound on side of each tomato. Fruits were held at indicated temperatures 14 days, then at 60° 14 days. Note that on tomato held at 60° throughout, spot is not much larger than original wound.

New attack on BRUCELLOSIS

New hope for more meat and milk for our growing population comes from a new plan recently worked out for eradicating brucellosis in the range cattle areas of the United States.

Developed by a "task force" of livestock producers and veterinarians at the North Central Brucellosis Conference in 1952, the new plan has been widely endorsed by livestock organizations, including the American National Cattlemen's Association, in which all the range States are represented. It is based on plan C, the calf vaccination program approved by the Bureau of Animal Industry as one of the procedures for eradicating the disease. It provides for certification of range and semirange areas without requiring a complete test of all animals in herds where official calf vaccination has been practiced for at least 3 years.

A. K. Kuttler, head of ARA's brucellosis work, says plan C usually takes longer to eradicate the disease than the test and slaughter plans, but it is sound and is practical and economical in the range areas.

The response of leading range cattlemen can be summed up in remarks by Tom Arnold, chairman of the Sanitary Committee of American National at its meeting in January 1953: "When the project is properly understood by the producers and all interested groups in the industry are permitted to participate in the development of the project, brucellosis will be less difficult to eradicate than some of the livestock diseases thus far successfully dealt with."

Kuttler, concurring in this statement, says: "I have never observed more genuine interest and understanding among the range people in the brucellosis project than exists at the present time. With the growing demand for milk from brucellosis-free cattle and the present attitude of the range people, I feel there should be no doubt about the future of brucellosis eradication."

Although brucellosis is being gradually reduced, it is still killing more than a quarter million calves every year before they are born. A third of them are in beef herds. And the loss of the calf is not the end of the misfortune. Infected cows produce about 22 percent less milk and 40 percent fewer calves.

To the Nation, brucellosis means the annual loss of a billion pounds of milk and millions of pounds of beef. And last year, Federal and State governments spent more than 11 million dollars for brucellosis control. It's less expensive in the long run to get rid of a disease than to live with it. This has been proved with tick fever, foot-and-mouth, and others.

Research has given us the tools to get rid of brucellosis. Whenever they have been properly applied, the disease has been eradicated. The response to the new range plan indicates that brucellosis will go.

Injections, supplements may give insect protection

Protecting animals from insects by injecting insecticides or putting chemicals in feed seems nearer as a result of research by the Bureau of Entomology and Plant Quarantine and Bureau of Animal Industry.

Entomologists report that they have been able to kill cattle grubs with injections of lindane, dieldrin, and aldrin. Except for one animal treated with aldrin, the cattle suffered no apparent ill effects.

This finding is the most encouraging in a long search for insecticides that could be given internally to kill cattle grubs and certain other external parasites such as ticks, flies, mosquitoes, and lice. This sort of chemical would be spread to all parts of the animal's body, so that a killing dose would be ready for insects that live in or on the animal, or pierce its skin to feed.

Special attention in current research is being given to a systemic insecticide that will stop the cattle grub. This pest is difficult to control and costs hundreds of millions of dollars yearly in meat, milk, and leather. In the recent experiments, lindane, dieldrin, and aldrin injections seemed to have no effect until the larvae appeared under the back. The entomologists hope to develop a safe treatment that will give earlier and longer lasting control.

Preliminary research over a period of years with mice, guinea pigs, and rabbits led up to other recent encouraging results with cattle, says entomologist E. F. Knipling.

In cooperative experiments with Oregon Agricultural Experiment Station, lindane destroyed deerflies on cattle within 8 hours after injection and gave a high percentage of kills for as long as 2 weeks. This treatment killed many mosquitoes for up to 3 weeks. Lindane-fed cattle also were kept free of horn flies.

Other work indicates that lindane,

dieldrin, and aldrin will protect calves against screw worm larvae. A South American found chlordane and benzene hexachloride effective against a pest like our cattle grub.

All these results look promising but we're a long way from a practical product for the farmer, Knipling warns. Chemicals used so far last only a short time. Even when we find the right insecticides and work out dosages, other problems will remain: How does long-continued use affect the animal? Is there danger of harmful residues in meat and milk? Such research is slow and costly.

Chemists help relieve fat surplus

ARA chemists are finding new ways to help relieve the Nation's serious animal-fat surplus.

Meat processors and rendering plants pile up 5 billion pounds of animal fats every year. But the market has slipped. Vegetable shortenings have taken the place of lard. Detergents are nosing out soap, once a big outlet for inedible fats.

The Bureau of Agricultural and Industrial Chemistry saw in these fats a raw material that might be modified chemically to suit the needs of a number of industries.

Products used in making vinyl plastics, poultry feed, and tin cans are among the recent discoveries.

Chemists of the Eastern Regional Laboratory found it's easy to turn fats into a good plasticizer, needed by plastics to make them pliable so they can be worked and moulded without cracking. Hydrogen peroxide is used to treat the fatty acids from animal fats. This adds an extra oxygen atom to the fatty-acid molecule, and the result is epoxidized oil.

This new plasticizer makes the plastic last longer by absorbing hydrochloric acid, which causes cracks and discoloring.

The fact that a plasticizer makes up as much as 30 to 40 percent of a plastic indicates the importance of this find. Three big companies already are making epoxidized oil for the growing plastics industry, which now produces some 500 million pounds of plastics a year.

ARA-sponsored research, in cooperation with American Meat Institute Foundation, has shown that more animal fats also could be used in pet and poultry feeds. In fact, one maker of dry dog food is now using three tank cars of tallow a month.

Animal fats may replace palm oil for the bath in hot-dip tinning of cans. This bath helps give steel cans a thin, continuous coat of tin. Animal fats do this important job better and last longer.

It's even possible that fats will get back into the dishpan and the washing machine some day. In fact, chemists already have made detergents from animal fats, but the cost is too high at present.

Fortified diet checks mange

Aureomycin and vitamin B_{12} may help pigs throw off mange, Bureau of Animal Industry scientists believe.

It's too soon for recommendations, but a preliminary test gave such striking results that research men plan to give the matter more study.

Mange is caused by a mite that burrows under the skin, resulting in itching, loose hair, bleeding, and scabs. Badly infested pigs may die. Those that live are unthrifty at best.

Parasitologist D. A. Shorb spotted mange at 7 weeks in a litter at the Beltsville Agricultural Research Center. He decided to check their reaction to a diet fortified with aureomycin and vitamin B_{12}.

Six pigs from the litter were separated into two groups of three. One group was fed a balanced mash; the other group got the same diet, fortified with growth stimulators.

The three pigs on the regular diet stayed mangy and made poor gains. Their weights at 2 and 5 months were (1) 23–37, (2) 23–46, and (3) 33–62.

But the pigs fed a fortified mash steadily lost mites, gained weight. Weights at 2 and 5 months were (1) 24–64, (2) 32–78, and (3) 32–86.

Low-pressure sprays stop sheep ticks

Sheep ticks can be controlled with low-pressure insecticide sprays if dipping facilities are not available, say ARA entomologists. Furthermore, when applied to sheep with short wool, low-pressure sprayers do as good a job as more expensive, high-pressure sprayers.

Shorn ewes and short-fleeced lambs sprayed with DDT, chlordane, toxaphene, or methoxychlor in April, May, and June with low-pressure applications were protected 100 percent for 4 to 6 months. Fall and winter spraying, when fleeces were heavier, also gave good results—94 to 100 percent control 4 months or longer.

Since good control depends on thoroughly wetting the fleece and because early control prevents buildup of ticks on the sheep, the entomologists strongly recommend spraying before fleeces are 2 inches long.

Best way to do the job is to crowd the sheep into a pen and soak them with a coarse, rainlike spray. Use 2 to 8 quarts of spray per animal, depending on the size of the sheep and the thickness of the fleece.

Kill the termites, save the shrubs

It now looks as if you won't have to worry about killing your shrubs when treating the soil around your house to keep out termites, say ARA entomologists. Although research has shown that in some cases termites can be kept out of buildings by applying insecticides to the soil around the exterior foundations, homeowners have been afraid to use them for fear of poisoning their shrubs and trees.

In 1949, entomologists began 5-year tests at Beltsville, Md., and at Gulfport, Miss., with some of the newer insecticides to determine if any of them would kill termites without killing plantings. Now they're pretty sure they have the answer in chlordane.

At Beltsville, a 2-percent chlordane emulsion was applied heavily to the soil around ivy, rhododendron, azalea, arborvitae, hemlock, and other plantings. The test was severe in that the treatments were made at midday during July when temperatures were above 90 and the plants were suffering from a prolonged drought. The chemical was applied on one side of the plants as would be done in actual use around buildings. After four seasons no injury has been detected. Standard field tests of wooden stakes placed in treated soil, begun at the same time, show the insecticide has been successful in keeping termites from attacking the wood.

At Gulfport, the 2-percent chlordane emulsion was applied to the soil in a shallow trench next to partially excavated areas and next to walls having full basements. So far, the termites have been kept out and the plants have shown no injury. Here, too, field tests have proved effective.

The entomologists will not be ready to make recommendations until the tests are completed next year. However, several commercial pest control operators are using chlordane now in an experimental way. Some of these tests, involving practical applications to termite-infested buildings, have been made by members of the National Pest Control Association in cooperation with ARA entomologists. These tests, too, have controlled the insects without injuring ornamental plantings.

Two diet surveys

Two methods of making family-diet surveys—one considerably simpler than the other—gave much the same results in a comparative study by the Bureau of Human Nutrition and Home Economics in cooperation with the South Carolina and Mississippi Agricultural Experiment Stations.

In one method, surveyors used a food list and interviewed homemakers at the end of a week as to the kinds and amounts of food they had used. Data taken in this way checked closely with figures gathered by the slow, costly method of asking families to record the weight of all food on hand at the beginning and end of a week and all the food they had brought home through that week.

Both methods are used in research on food markets, consumption practices, and diet nutritive quality. Both techniques take skill, the home economists emphasize.

Study details are covered in "Collection Methods in Dietary Surveys," Southern Cooperative Series Bulletin 23, available from the Bureau of Human Nutrition and Home Economics, USDA, Washington 25, D. C.

Pasture irrigation

Irrigating dairy pastures will pay well in the East when rainfall is below normal, judging from a cooperative trial with the Tennessee Agricultural Experiment Station.

A mixture of orchard grass, ladino clover, and alfalfa was used. Irrigated plots gave April-to-October grazing at 292 cow-days per year, with milk yields of 12,405 pounds per acre. Production rates on nonirrigated plots: 198 cow-days grazing and 8,382 pounds milk. Net returns were $121 per acre more on the watered pasture.